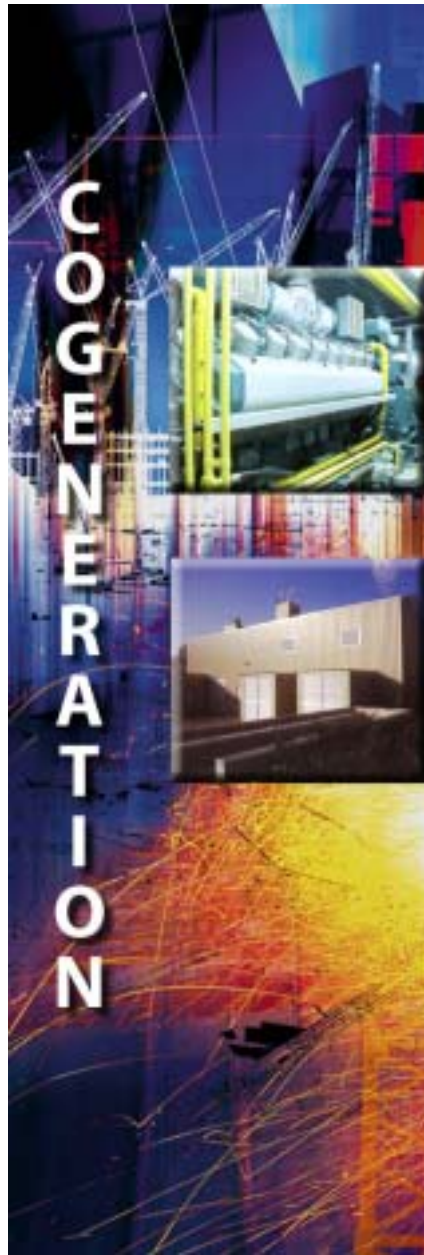
# Outline

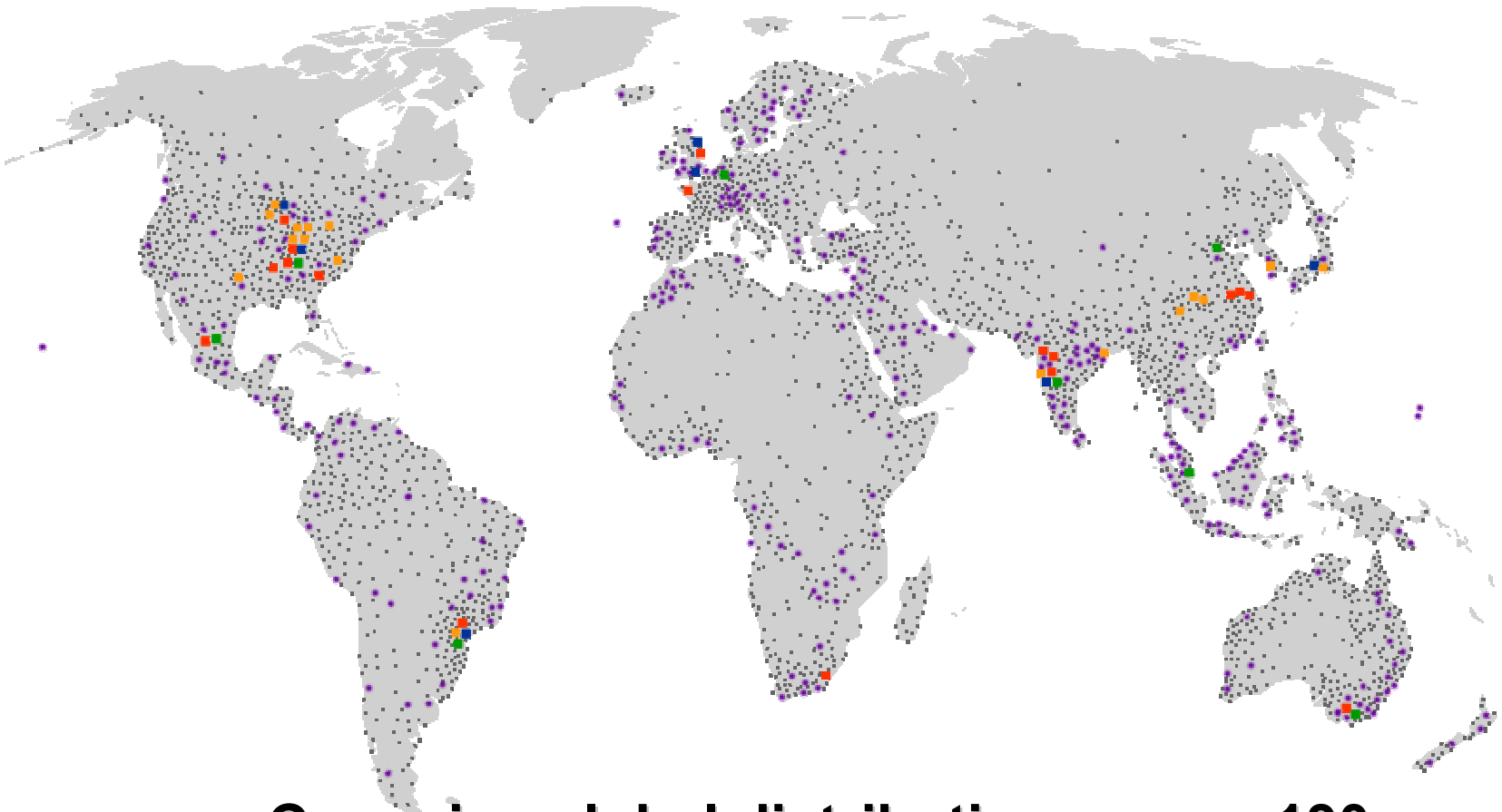
- Cummins Power Generation Overview
- CHP Overview
- Cummins CHP Experience
- Cummins CHP Solutions



# Cummins Overview

- Cummins Power Generation
  - Cummins, Inc: $6.6B Sales (2000), 28,500 employees
  - Cummins Power Generation: $1.4B Sales, over 500,000 units in service
  - The “Power of One”: Integrated Design, Sourcing, and Support of engine, alternator, controls, switchgear

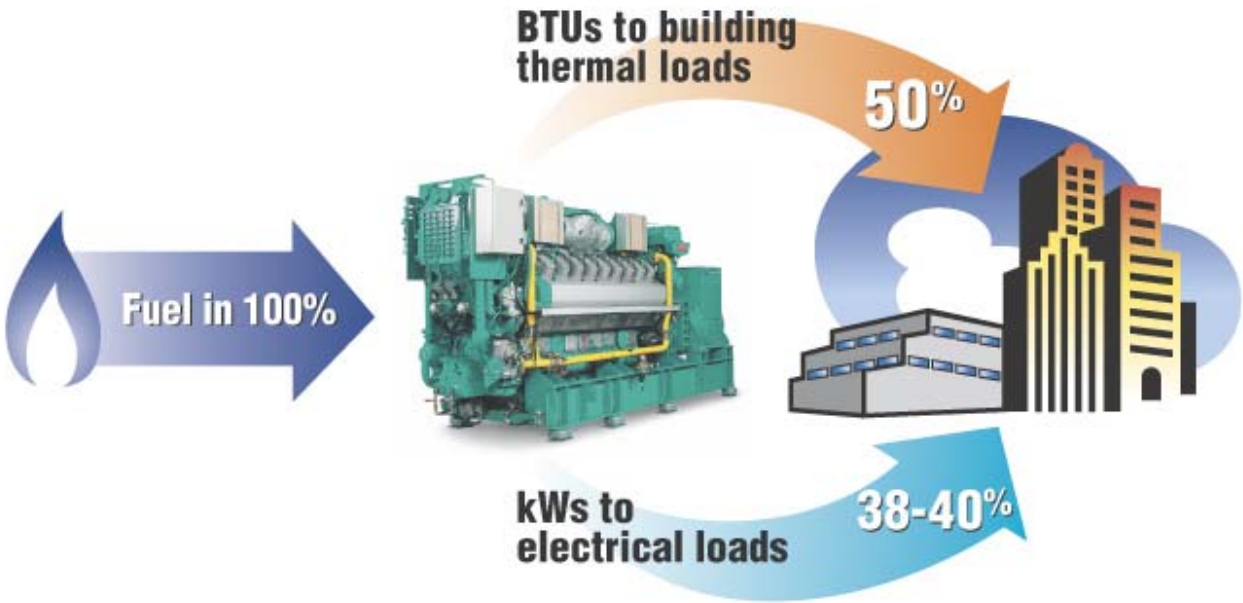

# Global Distribution and Support

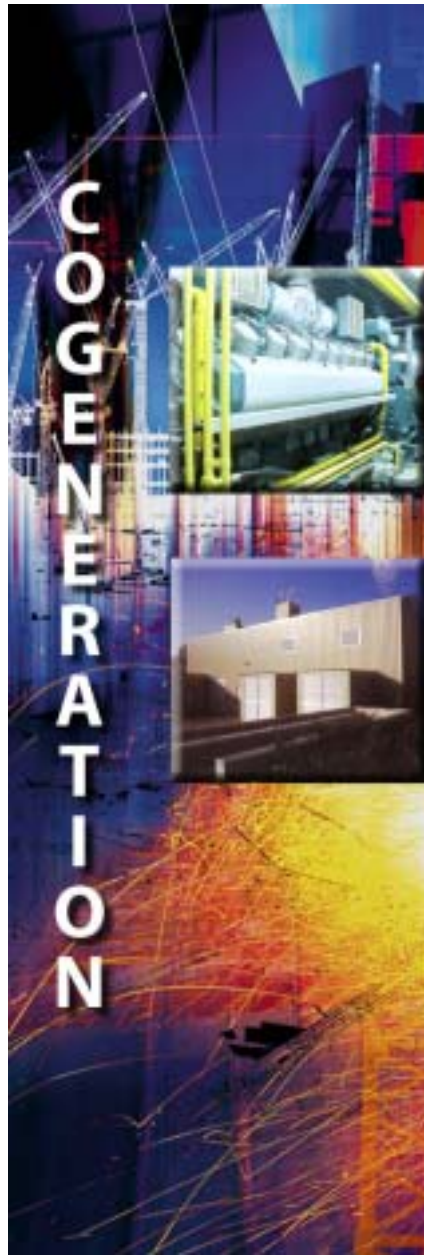


**Cummins global distribution covers 130 countries, with 143 distributors and over 4,000 service and parts outlets.**

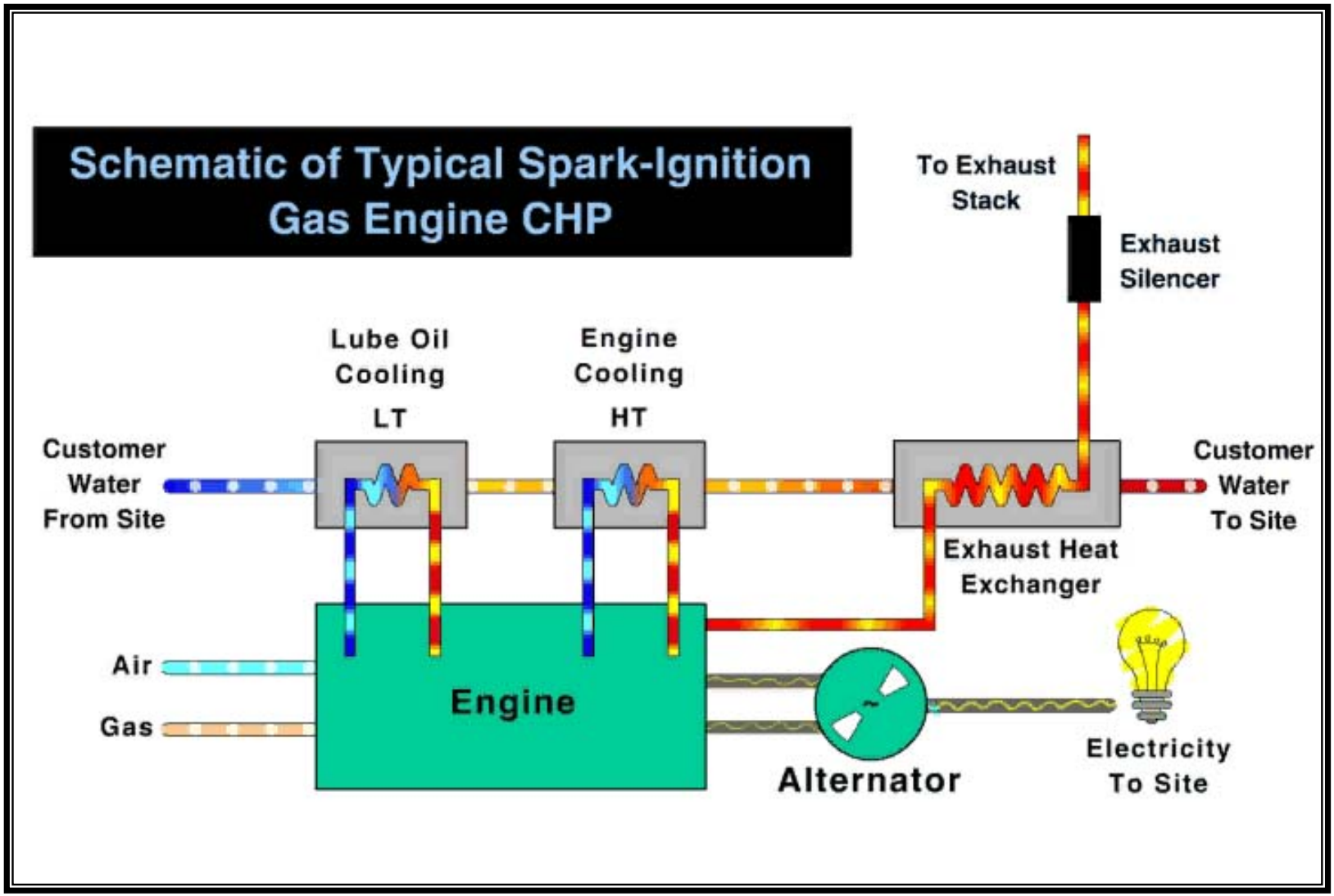
# CHP Overview

- Cogeneration, or Combined Heat & Power (CHP), utilizes the full potential of the input energy.
- CHP can reclaim over half of the otherwise lost fuel energy



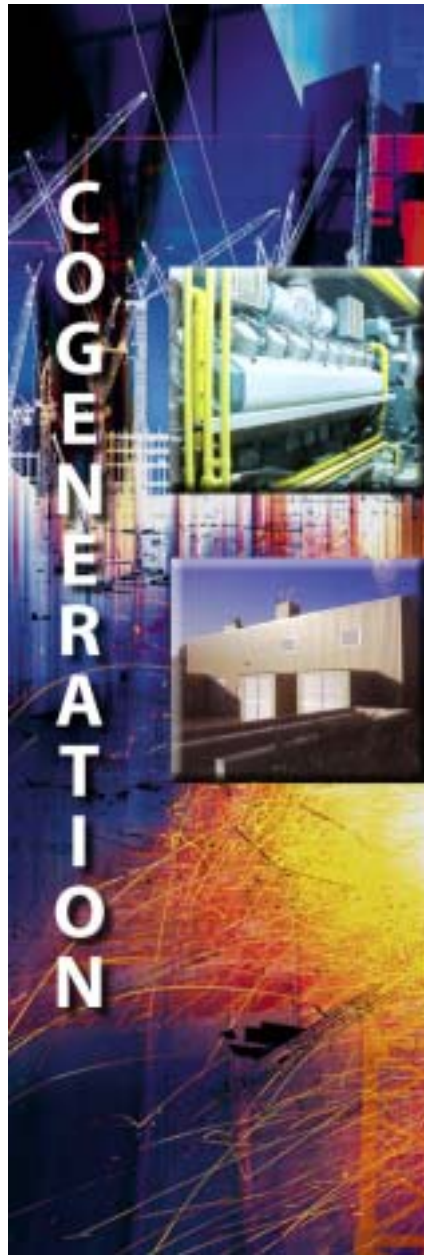
# CHP Schematic



# CHP Overview

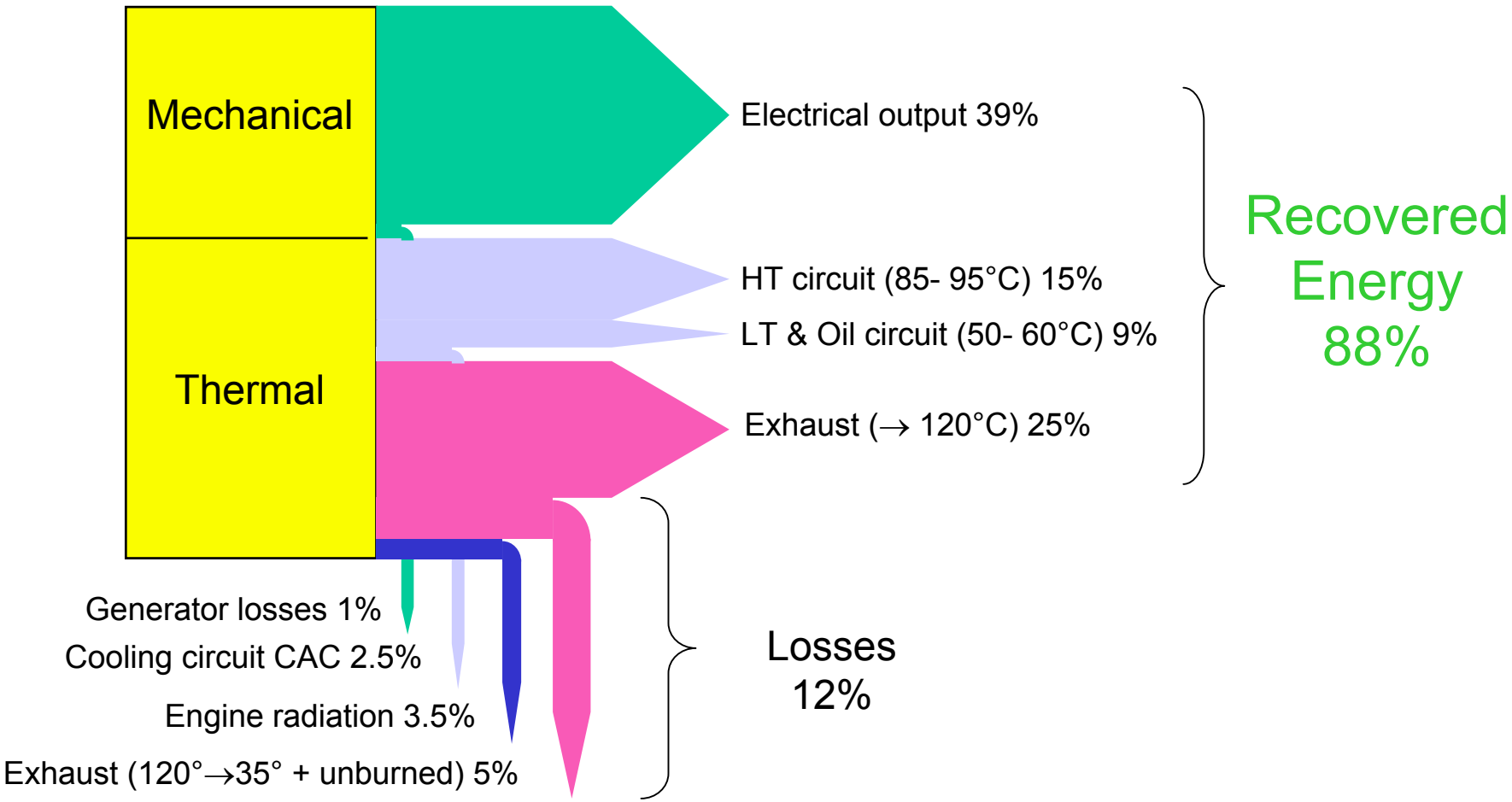
- CHP is not a new technology
  - Used in Thomas Edison's first electric generating plant in 1891
  - Used in industrial, institution, and municipal applications today

- Governments see the benefit for both fuel savings and emissions
  - US Department of Energy has a goal to double CHP use by 2010
  - European Commission has set similar targets



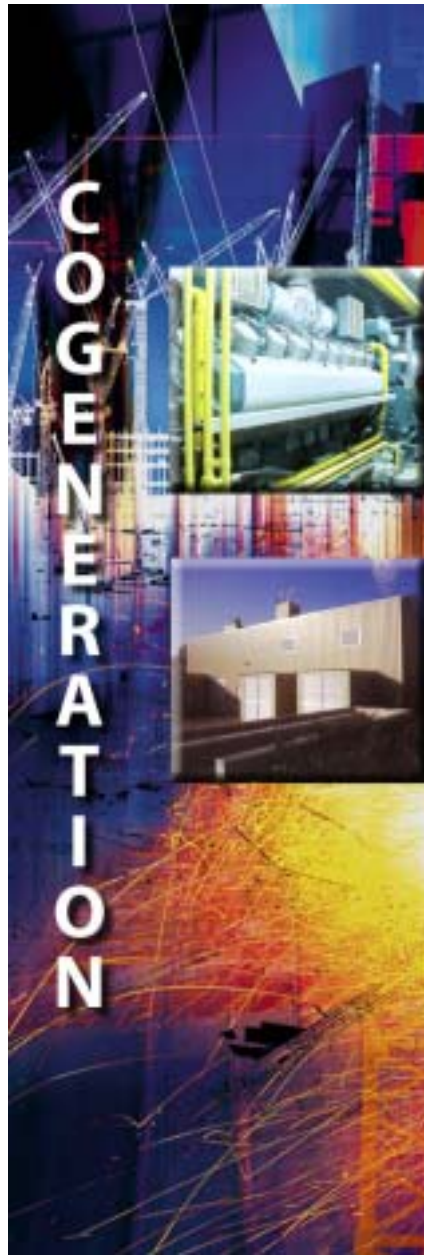
# Efficiency Benefit

## *Heat Balance: QSV91G*



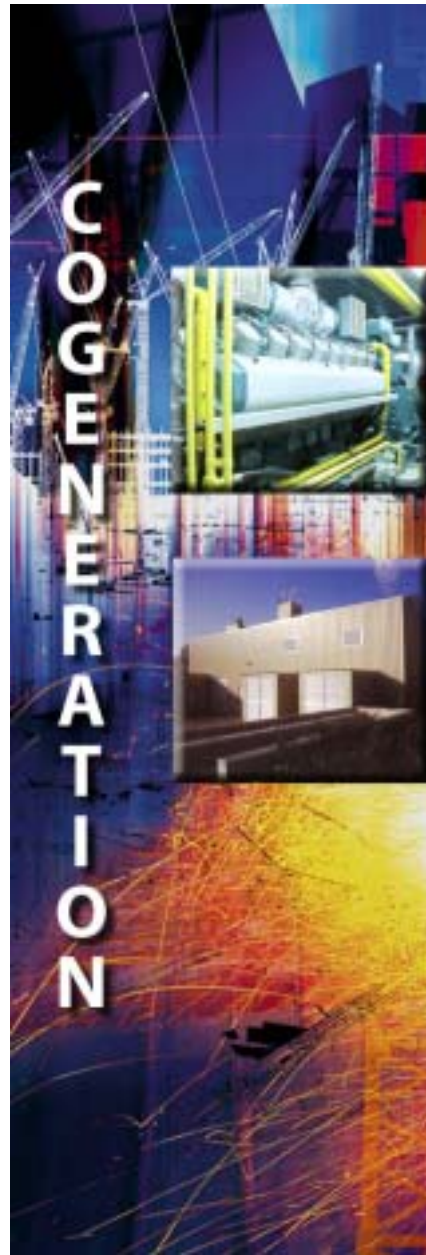
# Environmental Benefit

- Reduce demand on national electric grid
  - Power often produced by high emitting coal-fired plants
  - Reduction in CO2, NOx, and Particulates
- Higher efficiency means conservation of natural resources



# Typical CHP Applications

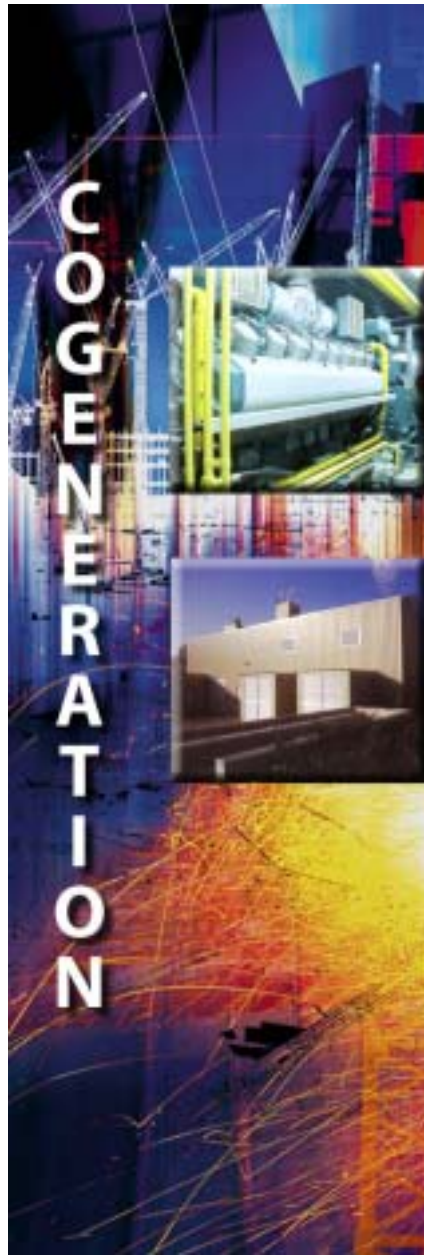
- Hospitals
- Greenhouses
- Hotels
- Industrial/Chemical Plants
- Manufacturing Facilities
- Commercial Facilities
- Government Facilities
- Colleges and Universities
- Food Processing Plants
- Health Clubs
- Swimming Pools
- Nursing Homes
- District Heating
- Landfills and Sewage Treatment Plants
- Coal Mining and Oil Fields



# Is your facility right for CHP?

Power Generation

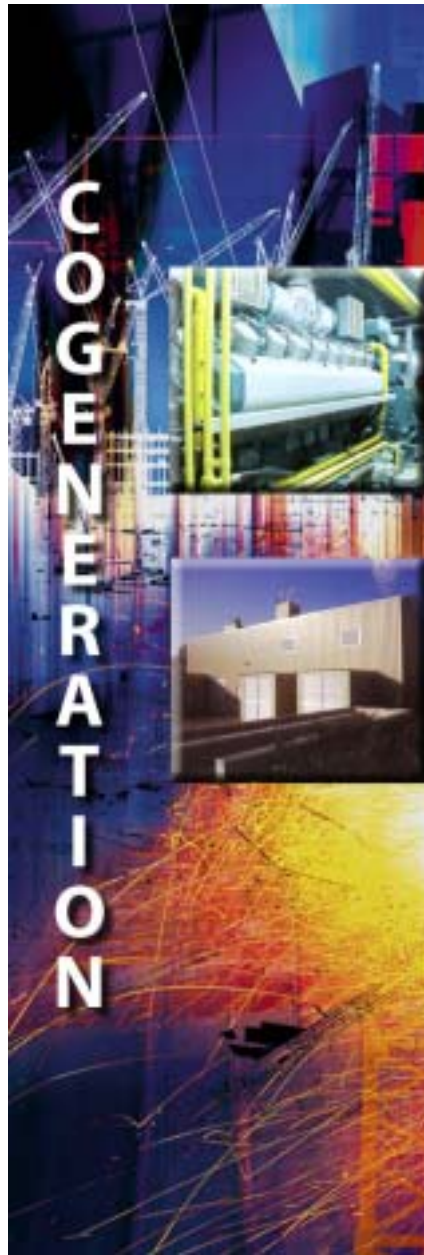
- Have you taken all reasonable steps to reduce both electric and energy consumption at your facility?
- Is the average electric load at your facility greater than 100 kW?
  - Generally shorter financial paybacks for larger facilities
  - Export opportunity if installation remains grid connected
- Is the average thermal load at your facility 500,000 BTU/hr or more?
  - Different types of thermal load requirements can be met: steam, hot water, absorption chillers
  - Note that different technologies have different heat to electricity ratios
- Is the duration of your simultaneous need for heat and electric power > 4,000 hours/year?
  - Can level your demand by meeting need for both heat & cooling



# Is your facility right for CHP?

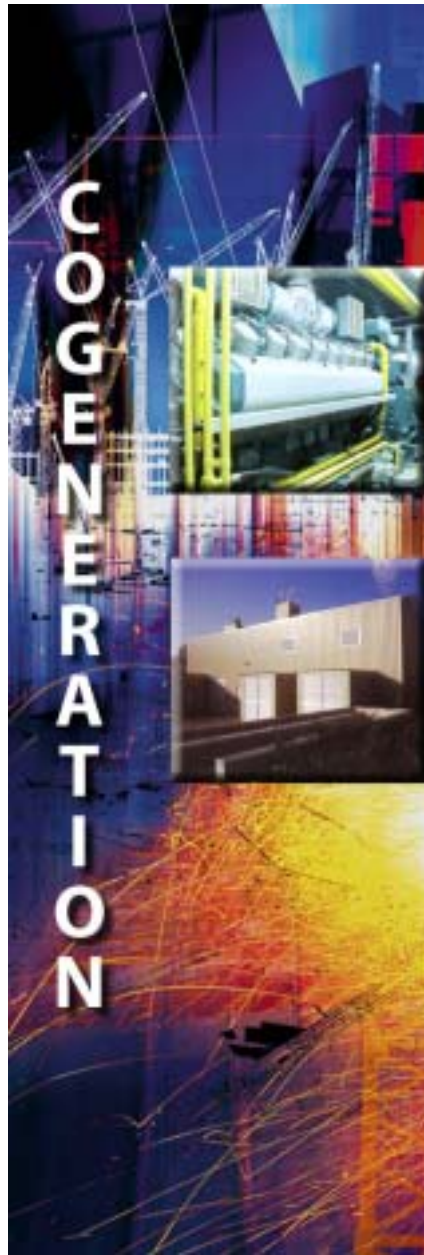
Power Generation

- Are local electric rates high in relation to the local cost and availability of natural gas?
  - "Spark-spread" biggest economic driver
  - Bigger gap offers more incentive for re-sale onto grid
- Is your physical site suitable for a CHP system?
  - Real estate: can meet with building or container options
  - Availability of natural gas supply
  - Air quality and noise standards can be addressed
- Is electric service reliability a major concern?
  - A CHP system can address generation or transmission reliability reliability issues
- Have you done the economic analysis?
  - Key inputs for Lifecycle Cost are electricity cost, fuel cost, hours of operation, and CHP system installed cost



# CHP Prime Mover Options

- Lean-burn Gas Generator Systems
  - Very low emissions
  - 200 kW to 30 MW systems
- Diesel Generator Systems
  - Lowest installed Cost
  - Excellent load-following characteristics
- Gas Turbine Systems
  - Less electrical efficiency and greater thermal output
  - Turbine options 3-100+MW
  - Micro-turbine options 30-60 kW
- Fuel Cell Systems
  - Ultra-low emissions
  - Very expensive demonstration projects at this point



# Case Study: Exhibition Center, UK

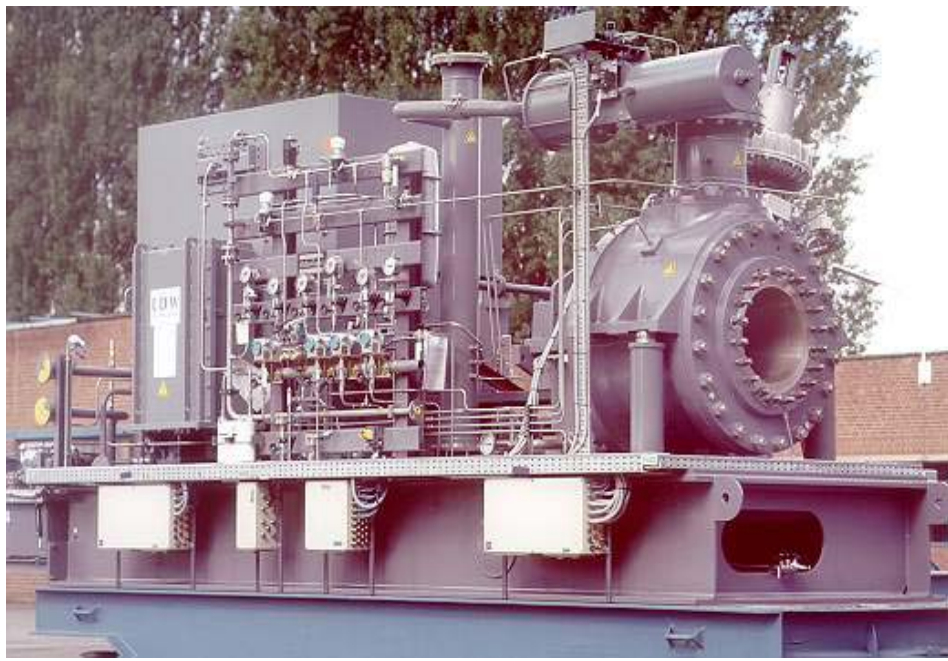
- ExCel Exhibition Center, London, UK
  - 1 x 1.35 MW Cummins QSV81G Gas Genset
  - 1.35 MW Electrical Output
  - ~1.3 MW(th) hot water
- Benefits
  - Medium Hot Water for winter
  - Cooling via chillers for summer
  - Parallel with and reinforce grid supply
  - Cummins guaranteed 15-year maintenance contract


# Case Study: Greenhouse, UK

- Hazelwood VHP Nursery, Kent, UK
  - Customer: Nedalo UK (CHP packager/IPP)
  - 6 x 1.5 MW Cummins QSV91G Gas Gensets
  - 9.2 MW Electrical Output
  - 11,58 MW(th) hot water
  - **"Tri-gen": Uses CO2 for plant growth**
  - Electrical Efficiency 36.5%
  - Total Efficiency 80.6%
- Benefits
  - Upgrade for old oil-fired boiler
  - Liquid CO2 plant food replaced with SCR-cleaned exhaust
  - Surplus electricity sold to grid
  - Lower emissions for electricity and eliminate fuel and CO2 delivery vehicles

# Case Study: Gas Distribution, Belgium

- Electrabel Gas Distribution Center, Brussels, Belgium
  - 2 x 1.35 MW Cummins QSV81G Gas Gensets
  - 2.7 MW Electrical Output
  - 2.7 MW(th) heating for gas expander
  - 0.8 MW(th) hot water for building
  - Electrical Efficiency 36%
  - Thermal Efficiency 50%
  - Total Efficiency 86%
- Benefits
  - Re-heat gas after turbo-expander
  - Provides hot water for facilities
  - Electricity sold to grid

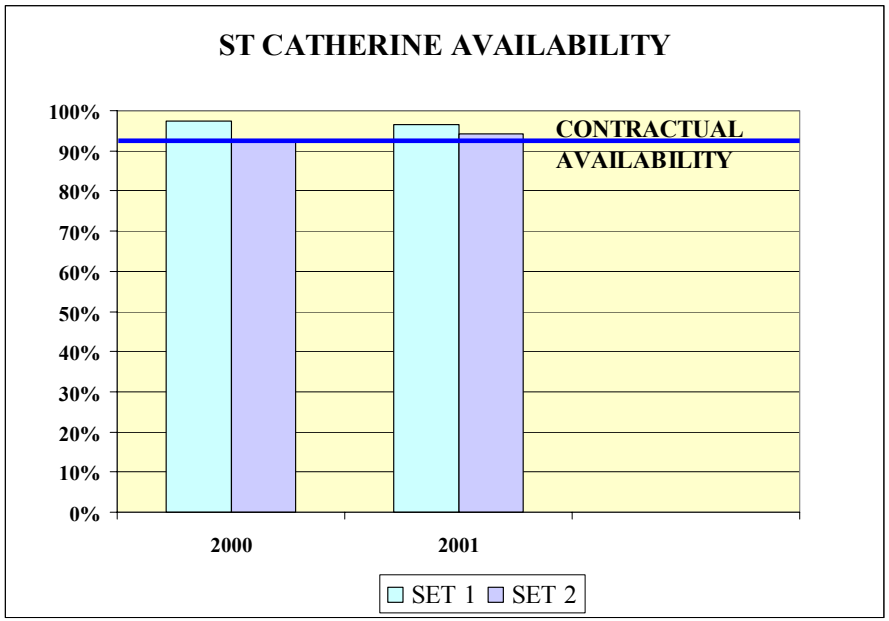


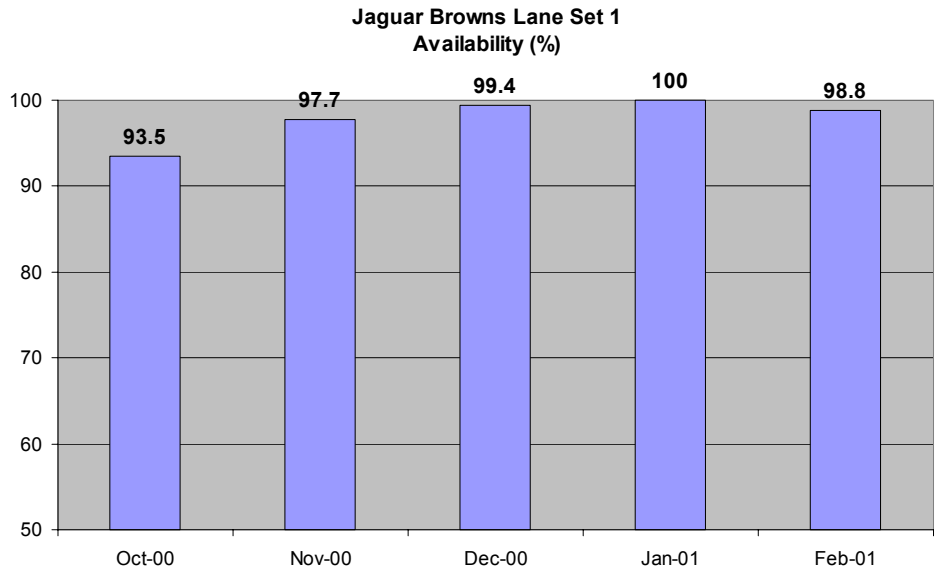
# Case Study: Shopping Center, Portugal

- Maia Shopping Center, Ermenside, Portugal
  - 2 x 1.35 MW Cummins QSV81G Gas Gensets
  - 2.7 MW Electrical Output
  - 2.66 MW(th) hot water

# Cummins Reliability

- Cummins Lean-Burn Engines Generators have already proven themselves in the global market
  - Over 200,000 hours of continuous duty operation
  - Over 125 MW of customer installations in CHP and Prime Power applications across the world
  - Proven reliability through consistent 90%+ product availability



# Lean Burn Gas Product Plan

Power Generation

| 1500 rpm | 1200 rpm | 1800 rpm | Product | 2002 Q1 Q2 Q3 Q4 | 2003 Q1 Q2 Q3 Q4 | 2004 Q1 Q2 Q3 Q4 | 2005 Q1 Q2 Q3 Q4 |
|---|---|---|---|---|---|---|---|
| 1750 | 1250 | 1750 gbox | QSV91G | | | | |
| 1500 | 1100 | 1500 gbox | QSV81G | | | | |
| 1160 | 950 | 1400 | QSK60G | | | | |
| 875 | 700 | 1050 | QSK45G | | | | |
| 540 | n/a | 650 | KTA38G | | | | |
| 315 | n/a | 333 | QSK19G | | | | |

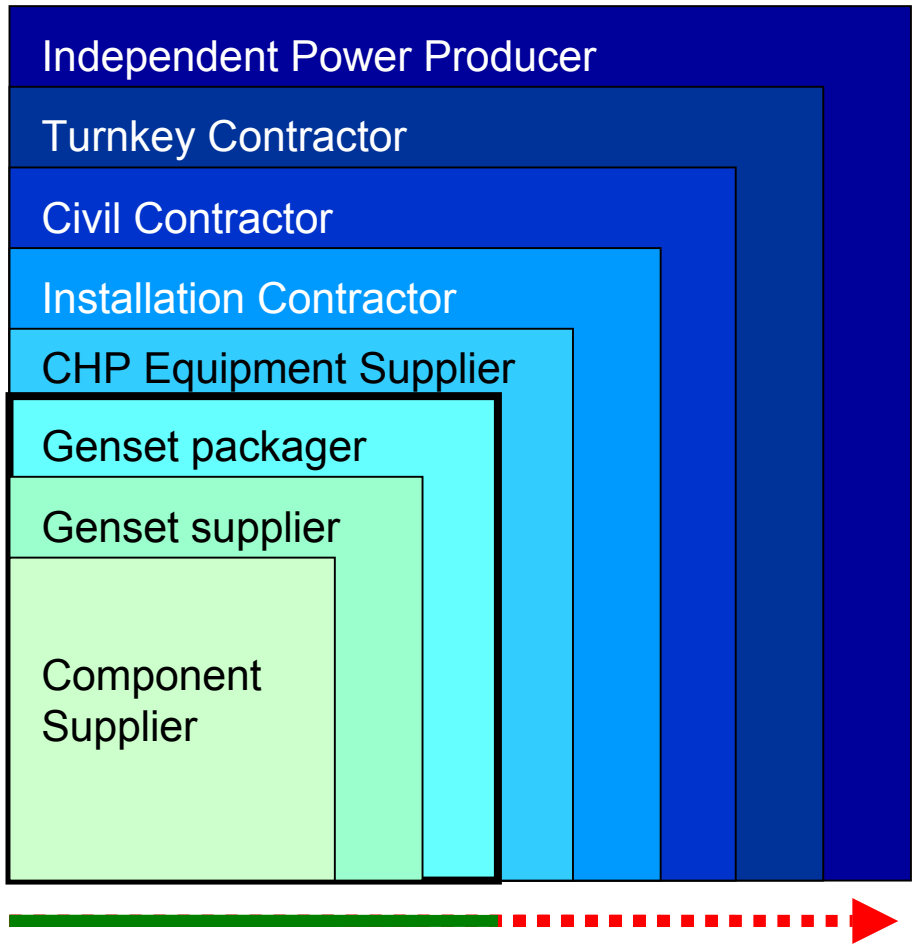
# Cummins Full System Solution

***Cummins offers a single point of contact***

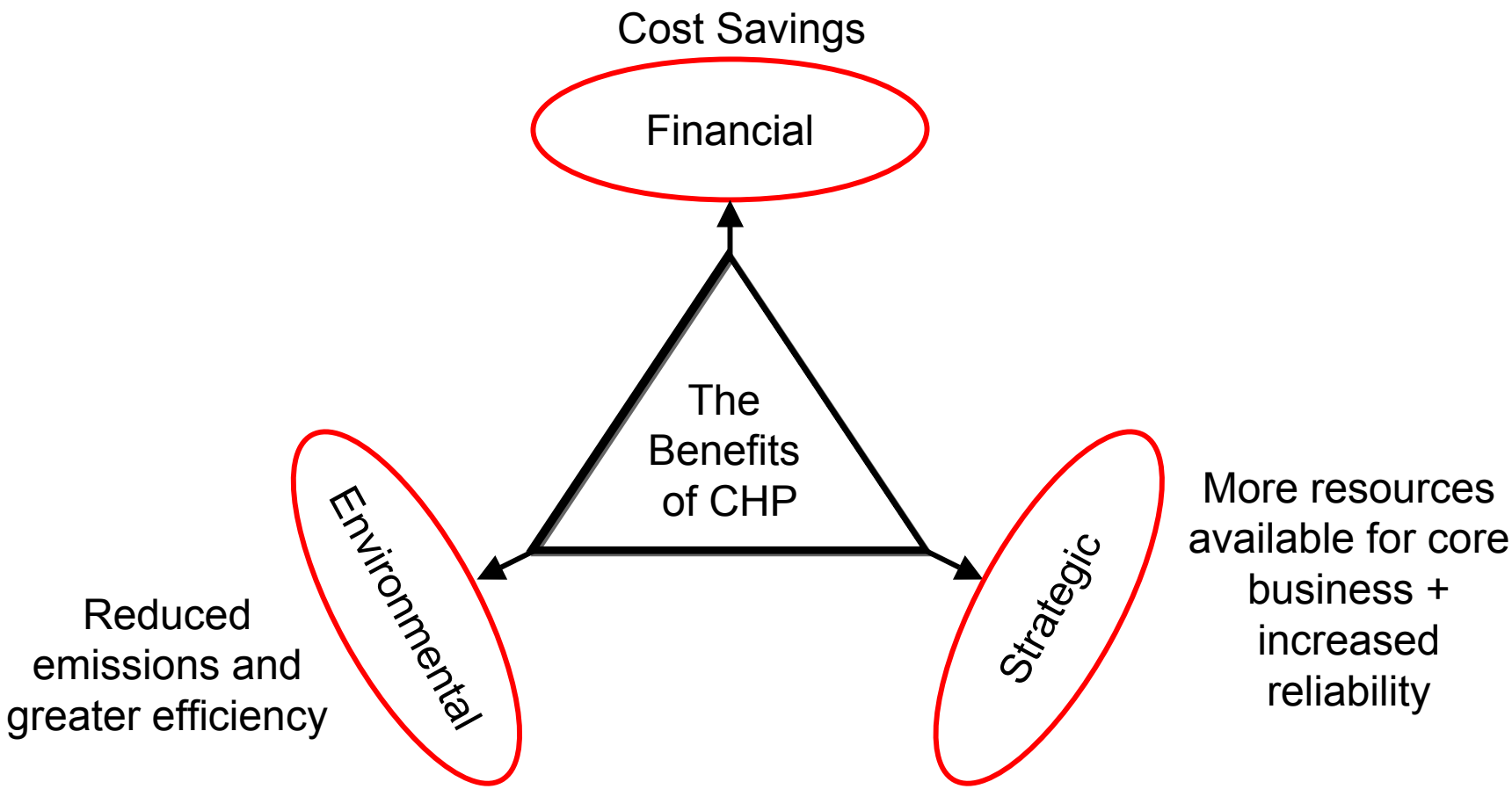
- ***Project Design***
- ***Specification***
- ***Installation***
- ***Financing***
- ***Power guarantees***
- ***Guaranteed maintenance contracts***

***The "Power of One"***

- ***Integrated Power Command***
- ***Lean-burn gensets***
- ***Diesel gensets***
- ***Microturbines***
- ***Digital Master Controls***
- ***Paralleling switchgear***
- ***Transfer switches… and more***



# Summary: Benefits of CHP



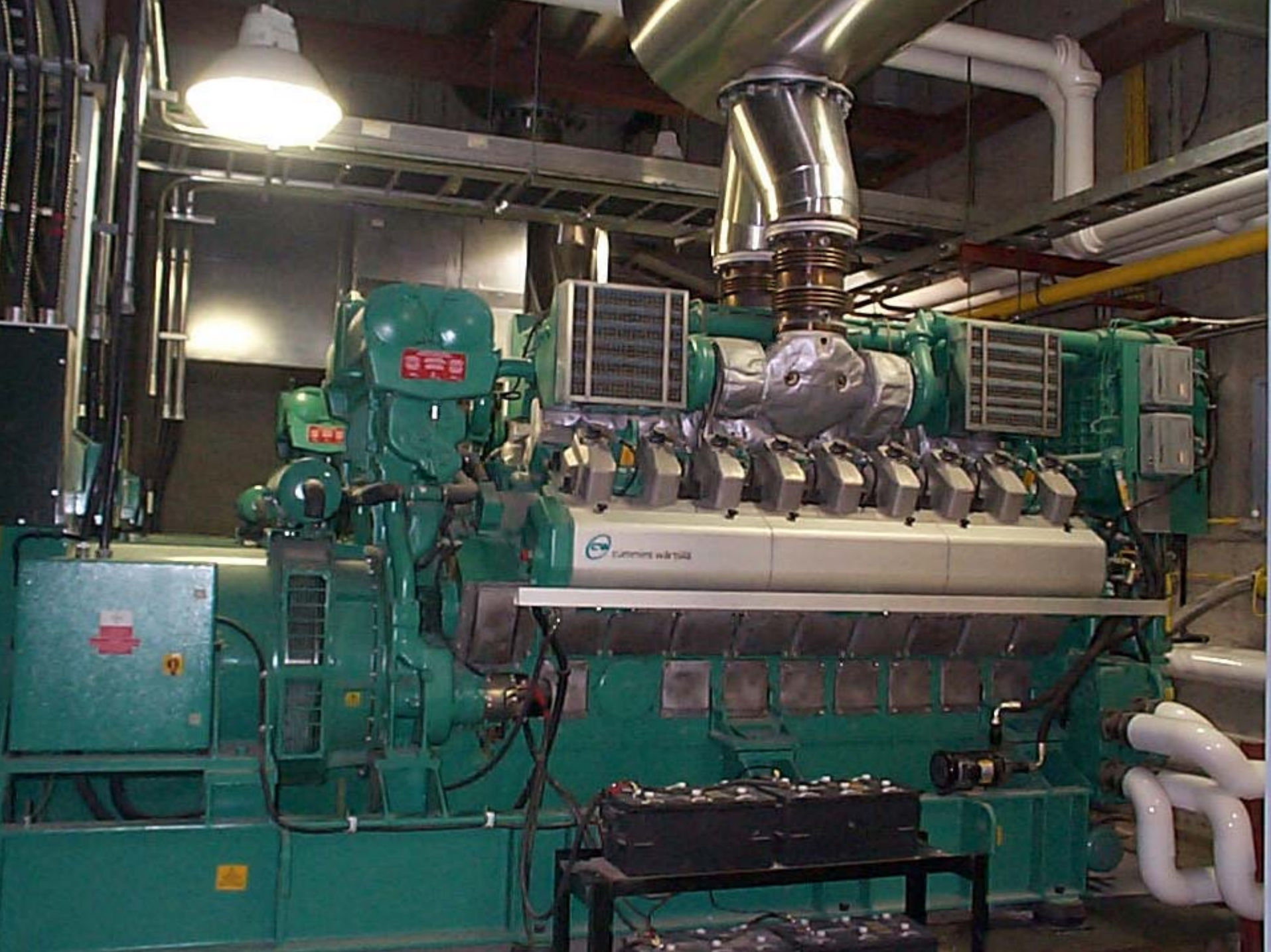

***Cummins Power Generation can provide your CHP solution***

# St. Catherine's Hospital Ontario

- Cogeneration System on line February '99
  - 2 x 1.25 MW Cummins QSV91 Gas Gensets
  - 2.5 MW Electrical Output
  - 5.12 mmbtu/hr hot water
  - Electrical Efficiency 38.9%
  - Thermal Efficiency 45.8%
  - Total Efficiency 83.9%


Co-Generation Project
for
Heat & Electrical Power Production
Completion – January 1999
THE ST. CATHARINES GENERAL HOSPITAL
IN PARTNERSHIP WITH
PENINSULA ENGINEERING INC.
PROJECT DEVELOPER & ENGINEERS
St. Catharines, Ontario 905-688-6061
Connor Clark Private Trust
Project Financing
Toronto, Ontario
Draticon Construction Ltd.
General Contractor
Niagara Falls, Ontario
1998. 12. 14


1999. 1. 11




#2 LGS